SCAG 2012 RTP/SCS Performance Metrics & Health

INTRODUCTION

Southern California Association of Governments (SCAG) recently proposed an initial set of performance metrics with which to analyze potential scenarios to be considered in the Regional Transportation Planning/ Sustainable Communities Strategies planning process.[i] A statewide group of public health advocates has been developing a set of performance metrics for use in the RTP/SCS process. In the past, public health and equity have not been fully considered in land use and transportation planning and we hope to inform the discussion of performance metrics with a health perspective. We appreciate that SCAG is seeking an inclusive, meaningful, and thorough policy debate, dialogue, and building of consensus.[ii] We thank SCAG and the PPTAC for considering the following suggestions of public health and equity professionals and advocates in the development of performance measures.

Given the high levels of chronic disease, including obesity, diabetes, and asthma, that we are facing as a country and that we spend a higher percent of our GDP on healthcare than any other country, it is imperative that we address the root causes of disease. While access to healthcare and genetics are important factors that determine our health status, there is a growing recognition that land use and transportation systems impact our personal behaviors related to health and directly and indirectly impact our health status even more. As described below, transportation systems impact health in many ways, for example through impacts on injuries and fatalities, environmental quality (e.g., air quality and noise), physical activity, and income. These impacts are typically not distributed evenly across all populations, with lower income populations and communities of color often facing worse impacts for a variety of reasons. Understanding the causes of these differences is an important piece of addressing them. For this reason, we believe that **equity (defined here to mean the absence of systematic disparities in health, or in the major social determinants of health, between groups with different levels of underlying social advantage/disadvantage[iii])** impacts be understood in addition to health impacts.

This document briefly summarizes existing evidence about many of the draft metrics proposed by SCAG and health outcomes. For each metric or group of metrics with similar impacts, we describe both the health impacts and equity impacts and provide preliminary recommendations regarding the inclusion or revision of the metrics. This document will be revised shortly to include a more comprehensive set of recommendations.

METRIC: SPEED

Health impacts

High speeds are a major cause of crashes and the severity of collisions for pedestrians, bicyclists and drivers is related to speed.[iv] Pedestrians have a 90% chance of surviving car crashes at 30 km/h (18 mph) or below, but less than a 50% chance of surviving impacts at 45 km/h (28 mph) or above.[v]

Speed also impacts health indirectly:

- Perception of road danger discourages walking and bicycling, two important sources of physical activity;[vi] physical activity has well-established health benefits.[vii]
- Higher speeds result in higher environmental noise.[viii] Noise has important health impacts including hearing loss,[ix] hypertension and heart conditions,[x] sleep disturbance,[xi] and learning delays in children.[xii]
- Emissions that cause air pollution vary with speed. As vehicles speed up from a stop, emissions of many pollutants decrease. When vehicles reach about 40 miles per hour (mph), emissions of some pollutants increase while others remain similar.[xiii] Air pollution from traffic is known to increase respiratory disease[xiv] and cardiovascular disease.[xv]
- Speeds above 40 mph also result in increased release of greenhouse gases that cause climate change.[xvi] Climate change will have a number of health effects including heat-related illness and death, health effects related to extreme weather events, health effects related to air pollution, water-borne and food-borne diseases, and vector-borne and rodent-borne disease.[xvii]
- Higher speeds can reduce travel time and thus may have a positive impact on health via time saved (see discussion below).

Equity impacts

Census data indicates that low-income earners and people of color are less likely to own cars,[xviii] high speeds benefit them less. Additionally, because housing prices are influenced by proximity to busy roadways[xix], low income earners, people of color, and their families are more likely to live near roadways with higher speeds, and thus are more highly exposed to the impacts of speed such as noise, differential emissions, and lack of walkability that impacts high speed roads.[xx] Pedestrian collisions are more common in low-income areas, potentially reflecting a greater traffic volume, and lower automobile ownership among residents of these neighborhoods.[xxi] These populations also have higher exposure to poor air quality and noise.[xxii]

Recommendations

Public health and equity professionals do not support having speed as a performance metric with the goal of increasing speeds and encourage deletion of this metric from the SCS RTP planning. We would support the use of speed as a performance metric but believe that the goal should be reducing speeds, not increasing or maintaining high speeds. Speed related metrics we suggest are:

- Share of urban road network with speed less than 30 mph
- Share of residential road network with speed less than 20 mph
- Restrict freeway speeds to below 55 mph

METRICS: RECURRENT AND NON-RECURRENT DELAY & PERCENTAGE VARIATION IN TRAVEL TIME (AUTO AND TRANSIT)

Health impacts

Delay in traffic or transit is associated with a multitude of negative health outcomes:

- Amount of time commuting impacts time for family and social activity.[xxiii] Social connectivity helps manage stress, and is connected with longer lifespan and access to emotional and physical resources.[xxiv] [xxv]
- Less time in the car means more time for physical activity and therefore reduced obesity rates. Each additional hour spent in a car was shown to be associated with a 6% increase in the likelihood of obesity, and each additional hour walked was associated with a 4.8% reduction in obesity.[xxvi] [xxvii] VMT and commute times correlate with obesity and have an inverse relationship to amount of physical activity.[xxviii] [xxix]
- Time spent driving puts drivers at risk for musculoskeletal pain. People who drive more have higher odds of shoulder pain compared to those who spend less time driving. People who drive 9,000 – 18,000 annual miles are 75% more likely to have neck and back pain than those who travel 3,000 miles annually.[xxx]
- Driving to work is the most significant cause of stress for many people, so reduced commuting time could lead to decreased stress levels.[xxxi] Highway congestion has been associated with elevated blood pressure among car or bus drivers.[xxxii] Some studies have looked specifically at "commute impedance," such as traffic jams, and road construction. Researchers have concluded that traffic impedance is associated with higher blood pressure, more self-reported "tense" and "nervous" feelings, more self-reported colds and flu, and more days at the hospital.[xxxiii]
- Vehicles idling emit as many air pollutants as they do while driving.[xxxiv]

It is important to note, however, that building or expanding freeways, thereby adding lane miles, has not proven to be a long-term solution to congestion. It can, in fact, exacerbate the problem by inducing travel.[xxxv] [xxxvi] [xxxvii] [xxxviii] [xxxix] Higher traffic volume increases the risk of pedestrian, cyclist and motorist injury and death, with pedestrians, cyclists, and motorized two-wheeled vehicle users bearing a disproportionate share of road injury burden.[xl] Transportation Demand Management strategies lead to better health outcomes than road expansions.

Equity impacts

- Lower income, transit-dependent households who work in industries that do not have regular 9 to 5 working hours are much more vulnerable to reductions in off-peak transit service. Jobs in the health care, retail, food and personal service, and hospitality industries, for example, have fewer educational requirements but also require odd hour commutes.
- These industries also tend to have less flexible working hours, making transit-dependent lower income households are more vulnerable to travel delays.

Recommendations

Due to the daily health impacts of longer commute times, we support having a performance indicator measuring travel time by mode for work and non-work trips (auto including carpool, transit, and walking/biking) in key corridors/communities. As supplementary metrics, we also suggest:

- Percent of work and non-work trips taken by public transit, SOV, bicycle, walking, and carpooling
- Number of minutes of physical activity through active transport
- Percent of transportation budget dedicated to reducing private vehicle use, including HOV lanes, TDM strategies, public transit projects, and bike and pedestrian projects

METRICS: PERCENT OF PM PEAK PERIOD WORK TRIPS WITHIN 45 MINUTES OF HOME (AUTO AND TRANSIT) & DISTRIBUTION OF WORK TRIP TRAVEL TIMES

Health impacts

Commute time between the home and the workplace can be a good indicator of environmental impacts, physical activity, obesity, social cohesion, and mental health. The extent of these impacts depends on transit mode. Health impacts of long commutes can include the following:

- Vehicle miles traveled are directly proportional to air pollution and greenhouse gas emissions.[xli] Air pollutants, including ozone and particulate matter, are causal factors for cardiovascular mortality and respiratory disease and illness.[xlii] Greenhouse gases contribute to climate change, which may increase the following: heat-related illness and death, health effects related to extreme weather events, health effects related to air pollution, water-borne and food-borne diseases, and vector-borne and rodent-borne disease.[xliii]
- The more time a person spends in a car, the less time a person has to engage in leisure time physical activity.[xliv] Use of public transit, on the other hand, can help increase physical activity: Americans who use public transit spend a median of 19 minutes daily walking to and from transit; twenty-nine percent achieve at least 30 minutes of physical activity a day solely by walking to and from transit.[xlv]
- Physical activity or inactivity, in turn, leads to mental health outcomes. Physical activity can reduce stress, depression, and anxiety, and improve mental health and sense of well-being.[xlvi]
- Transportation choices impact obesity. Each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity. Each additional hour walked per day is associated with a 4.8% reduction in the likelihood of obesity.[xlvii]
- Long commutes can distance an individual from his/her community and decrease social connectivity. Social connection has a variety of health impacts, ranging from reducing stress, having a longer lifespan, supplying access to emotional and physical resources.[xlviii]
- Drivers in the Southern California region have especially long work trip travel times. For example, Los Angeles and Riverside were ranked by the US Census as having the fourth

and fifth highest percentages of people with "extreme" commutes of longer than 90 minutes per day (5% and 3%, respectively),[xlix] and 20% of those living in the larger Los Angeles region commute more than 45 minutes each way to work.[l]

Equity impacts

Residents in low-income communities are less likely to own a car and rely on public transportation to a greater extent,[li] and therefore often have longer commutes. People of color are also more likely to use transit and carpooling to get work, increasing the likelihood of longer commute times.[lii] Costs and inaccessibility to public transit are barriers to accessing one's workplace and other resources.

In the Los Angeles region, 11.15% of the total population (727,523 people) had a commute that was over 60 minutes in 2000. Nationally, people of color tend to have longer commuters than the white population, with a lower share of African-Americans, Asians and Hispanics enjoying commutes under 20 minutes and a higher share of people of color having "extreme commutes" over 60 minutes.[liii]

Recommendations

Because travel between the home and the workplace is a daily event for most people and has the potential to impact health in a variety of ways, we support performance metrics relating to commute time. However, we question the threshold of 45 minutes and feel that using this value is not an appropriate indicator of health, environmental sustainability, and climate change impacts. National metrics on travel time use 60 minute and 90 minute commutes as a threshold for "extreme commutes," and there is strong evidence that the share of commuters making these longer trips is growing, especially in California.[liv] In addition, the two existing metrics pertaining to travel time do not specifically include active transit modes such as walking and bicycling. In order to decrease the number of single occupant vehicles and increase use of transportation choices such as walking, cycling, carpooling, car-sharing, vanpooling and public transit, we recommend measuring travel time and mode share for vehicles (single occupant and carpool), public transit, walking and bicycling. Commute time metrics we suggest are:

- Travel time by mode for work and non-work in key travel corridors/communities
- Peak period mode share in key travel corridors/communities

METRIC: AVERAGE COMMUTE DISTANCE

Like commute time, commute distance between the home and the workplace is an indicator of a variety of health impacts. While commute time (above) indicates health effects caused by personal time spent traveling, distance in particular is a meaningful indicator for assessing air emission and climate change impacts of *vehicles*, which emit more pollutants per traveler with increasing distance. Other determinants of health impacted by long vehicle commute distances include roadway noise, collisions involving vehicles, social cohesion, and mental health.

- Health impacts determined by vehicle commute distance are summarized above in the section about commute time.

- Research has found that proximity to public transit helps to determine travel choice.[lv] For normal trips, only 10% of Americans will walk one-half mile. A recent study in King County, WA demonstrated that for every quarter mile increase in distance to transit, the likelihood of using transit fell 16%. One-third of communities near transit stops in the San Francisco Bay Area used rail to commute to work.[lvi]

Equity impacts

Commute distance can be an indicator of travel costs: longer commutes are generally associated with higher costs of gas, vehicle wear and tear, and/or public transit fares. Low-income populations spend a higher proportion of their income on travel costs associated with commuting, and thus bear this cost burden to a greater degree.

Recommendations

In its current form, this metric is an indicator for impacts associated with vehicle travel but it does less to capture impacts of non-vehicle commutes, whose health impacts are more closely associated with commute time. We recommend measuring *vehicle* commute distance specifically, as well as resident proximity to public transit, which would reduce the need for vehicle travel. Commute distance metrics we suggest are:

- Travel time by mode for work and non-work in key travel corridors/communities (and comparison of travel time by mode)
- Median distance for work and non-work trips
- Percent of population within ½ mile (or 10 minute walk) of a high-frequency (every 10 minutes during peak periods) transit stop

METRIC: SHARE OF GROWTH (POPULATION, JOBS, HOUSING) IN TRANSIT PRIORITY AREAS

Transit-oriented development (TOD) is effective for regional reducing vehicle use and associated air pollutant emissions (including greenhouse gas) and noise, and for improving traffic safety, access to goods and services, and access to schools and jobs. Transit-oriented development is generally positive for health at the regional level but local health impacts may not be positive. Due to decreasing amounts of urban land available for infill, many of these developments are now placed close to freeways and their associated air pollution and noise. Additionally, access to public transit stops can increase local traffic, leading to an increase in risk for pedestrian and bicycle injury. Provided that local air quality and traffic collision impacts near TOD sites are mitigated, this metric can be positively associated with health.

- Transit-oriented development can increase physical activity.[lvii] In San Francisco, transit neighborhoods had 120% more trips by walking or biking to work than did auto-orientated neighborhoods. Mode share for work trips by pedestrians was between 1.2 and 10.6% higher for the transit neighborhoods. In Los Angeles mode share for walking to work was 1.7 to 24.6% higher in the transit neighborhoods.[lviii]

- A dense mix of uses, well served by mass transportation systems, can ensure access to essential needs and services while reducing vehicle miles traveled (VMT), thereby reducing environmental and health costs associated with personal vehicle trips.[lix]
- Transit-oriented development areas can be associated with increased vehicles on a local level, even as it reduces vehicle miles traveled overall. Consequently, high VMT per capita leads to higher accident and injury rates associated with vehicle-vehicle, vehicle-pedestrian, and vehicle-bicycle collisions.[lx] In addition, there are typically more pedestrians in dense TOD areas, which leads to greater risk of pedestrian collisions. [lxi]
- While transit-oriented development is often associated with reduced vehicle trips and VMT regionally, it can be associated with greater air pollution locally.[lxii]

Equity impacts

Increasing the share of growth in transit accessible areas can have positive or negative outcomes for low income people and people of color, depending on the other policies in place.

Positive equity impacts include:

- Decreased transportation costs. Building more market rate and affordable housing near transit allows more people to take advantage of the transportation cost savings provided by these locations.[lxiii]
- Increased economic opportunity. As more jobs are accessible by transit, low income workers (who may already be living in transit-rich neighborhoods) may be able to take transit to those jobs. Nationally, the number of households earning $35,000 and under is 10 percentage points higher in neighborhoods around transit than it is in the transit zones' host regions.[lxiv]

Negative impacts are also possible if proactive policies and planning measures are not in place.

- Because many transit areas have a higher share of low income households, negative public health impacts could have a disproportionate affect on those families.
- In addition, there are significant current and historical environmental injustices related to low-income communities and communities of color having disproportionate exposures to hazardous air quality associated with freeways, which may be perpetuated by increasing growth in places with these characteristics.[lxv]
- The demand for housing near transit is equally strong amongst all income groups.[lxvi] New development, including transit-oriented development, can lead to a risk of displacement for existing low-income populations. This can be mitigated by providing affordable housing in TOD areas[lxvii] and by stabilizing rent prices for local small businesses.

Recommendations

Based on the large number of positive health impacts associated with population, housing and job growth in transit priority areas, we support the inclusion of this indicator. We also

recommend the following supplementary metrics, which we believe would add value to understanding health and equity impacts of transit-oriented development:

- Share of growth (population, jobs, housing) in transit priority areas stratified by race/ethnicity, income and age
- Percent of income spent on housing and transportation
- Percent of existing and new below-market rental housing units in TOD areas

METRICS: TRANSIT MODE SHARE & NON-MOTORIZED MODE SHARE & TRANSIT UTILIZATION

Transit mode share is an indicator of how many people are driving, driving alone, taking public transit, or using active transportation such as biking or walking.

Health impacts

There are a variety of negative health outcomes, noted above in the travel delay section, associated with increased amounts of driving. These include increased stress, musculoskeletal injuries, noise and air emissions, and a decrease in physical activity and social cohesion (see bibliography for citations).

There are some positive and some additional negative health outcomes associated with use of alternative modes of transportation:

- Americans who use public transit get more exercise. For example, public transit users spend a median of 19 minutes daily walking to and from transit; of these individuals, 29% achieve at least 30 minutes of physical activity a day by walking to and from transit.[lxviii] [lxix] This level of physical activity enables people to reach the Centers for Disease Control's recommended amount of daily physical activity simply by taking public transit.[lxx] In fact, 16% of all recorded walking trips are part of transit trips, and these tend to be longer than average walking trips, according to an analysis of US travel survey data.[lxxi] Meeting recommended levels of physical activity lowers risks for obesity, cardiovascular disease, diabetes, cancers, depression, and can increase strength for bone health.[lxxii] Higher use of public transit has been shown to be beneficial for air quality and decreases greenhouse gases.[lxxiii]
- More active transport increases the amount of physical activity people get. Walking and biking have direct health benefits, for example lower rates of premature mortality, heart disease, diabetes, high blood pressure, colon cancer, depression and anxiety, obesity, osteoporosis, and psychological well-being.[lxxiv]
- Using public transportation also offers more opportunities for decreasing isolation by encouraging casual contact from unplanned social interactions. Mortality rates of socially isolated people are two or more times the rates of people with more social support.[lxxv]
- Increased use of car sharing has been shown to reduce vehicle travel by 47 percent and increased use of public transit, walking and cycling.[lxxvi]

- There are increased rates of crime near subway stations, however this increased risk as well as perception of safety can potentially be mitigated.[lxxvii]
- Active transport is associated with increased exposure to pedestrian or bicycle injury, but with well-designed communities, this risk can be mitigated.

Equity impacts

- Lower income residents are less likely to own automobiles – about 26% of low income households do not own a car compared to 4% of other households. Thus, lower income residents are more likely to use public transportation; 5% of lower income households use public transit vs. 2% of other households. Also, lower income residents are more likely to walk; 5% of lower income households report walking to work and work-related trips vs. 3% for other households.[lxxviii] Those walking and biking and taking transit can gain all of the health benefits associated with those modes.
- Low income households spend a higher percentage of their income on transportation costs than high income households.[lxxix] Car ownership can be estimated to cost a household about $5,000 annually, including the costs of gas, insurance, etc. Households that take more transit, or walk and bike more often will see significant cost savings.

Recommendations

Given the many negative health impacts associated with increased driving and positive health benefits associated with use of public transit and active transportation, we support the use of performance measures of mode share. In particular we suggest collecting proportion of the population using pedestrian, bicycle, and public transit modes of travel for work and non-work trips and setting performance goals, consulting public health and equity experts appointed to participate on the PPTAC.

- Stratifying mode share by income will help expand the picture of how different income groups are impacted by using the different modes of transportation.
- Percent of population within ½ mile (or 10 minute walk) of a high-frequency (every 10 minutes during peak periods) transit stop

METRIC: ACCESS TO PARKS/OPEN SPACE

Health impacts

Access to parks and open space is associated with higher levels of getting the amount of physical activity recommended by the CDC. People who live closer to parks are more likely to use them for physical activity.[lxxx] Having park space available has increased the amount of exercise that residents get.[lxxxi] For example, a 1% increase in park space can increase physical activity in youth by 1.4%.[lxxxii] Nationally, about 30% of physically active people report exercising in public parks.[lxxxiii]

Access to parks and open space is also associated with higher levels of social interaction, which has positive impacts on mental health through higher social support and better social networks.

In a study in Chicago, observations of vegetated areas with trees and grass indicated that green spaces contained on average 90% more people. In addition, 83% more people were involved in social activities in green spaces versus barren spaces.[lxxxiv]

Finally, exposure to green spaces has mental health benefits separate those accumulated through social interaction. One study showed that people dissatisfied with their available green spaces have 2.4 times higher risk for mental health issues.[lxxxv] The Chicago study mentioned above showed that people living in a housing project who had some green space near them scored higher on the ability to manage major life issues, procrastinated less, found their issues to be less difficult, and reported them to be less severe and long-standing than those who lived in barren surroundings.[lxxxvi]

Equity impacts

Low income communities and communities of color frequently do not have as much access to parks and open space. For example, a study conducted in North Carolina, New York and Maryland found that minority and low-income neighborhoods were significantly more likely than white and wealthier neighborhoods to lack recreational facilities such as tracks, skate parks, pools, tennis courts, racquetball/squash courts, and general sports fields. When facilities were available in these neighborhoods but not within parks, most of these resources required a fee. When recreational facilities were within parks in the poor and minority neighborhoods surveyed, however, resources were usually denser, free to use, and sports-related.[lxxxvii]

This same trend exists in Southern California counties.[lxxxviii] In Los Angeles, white neighborhoods include 31.8 acres of park space for every 1,000 people, compared with 1.7 acres in African-American neighborhoods and 0.6 acres in Latino neighborhoods.[lxxxix]

In Concord, CA, a Health Impact Assessment (HIA) looked at access to parks in an exurban area. In a lower-income community, there were only 1.2 acres per 1,000 people vs. 5.3 acres per 1,000 people in higher income areas.[xc]

Parks play a critical role in facilitating physical activity in minority communities, by providing recreational facilities, scheduled and supervised activities, and destinations to which people can walk—even though they may be sedentary after arriving there.[xci]

Recommendations

We recommend the inclusion of the following metrics:

- The proportion of residents within a ½ mile (or 10 minute) walk of parks and open space stratified by income and race/ethnicity
- Number of acres of parks/open space for every 1000 residents

METRICS: ACCIDENT RATES (FATALITIES, INJURIES, AND PROPERTY) PER MILLION VMT BY MODE & NUMBER OF COLLISIONS PER MONTH

Health impacts

Number of collisions is directly tied to injuries and fatalities. Traffic crashes continue to be the greatest single cause of death and disabilities for Americans in the 1-44 years of age.[xcii] California's pedestrian fatality rates are much higher than the nation's, with pedestrians accounting for more than 17% of motor vehicle deaths in California.[xciii]

The lifetime odds of dying as a car driver or passenger are 1 in 261, compared to 1 in 64,596 as a bus occupant or 1 in 115,489 on train.[xciv] Areas with high levels of vehicle miles traveled per capita tend to have higher collision and injury rates. More time in a car means higher exposure to the perils of driving, including collisions.[xcv]

There is a statistically significant relationship between traffic volume and the number of vehicle collisions involving a pedestrian.[xcvi] [xcvii] [xcviii] [xcix]

The risk of pedestrian injuries may discourage walking as a mode of transport, and negatively impact physical activity levels. The perception of collision risk prevents people from cycling. In a survey of adults in the Vancouver metropolitan area, the top deterrents were the risk of injury from car-bike collisions; the risk from motorists who don't know how to drive safely near bicycles; motorized vehicles driving faster than 50 km/hr; and streets with a lot of car, bus, and truck traffic.[c]

Equity impacts

Pedestrian collisions are more common in low-income areas, potentially reflecting a greater residential density, greater traffic volume, and lower automobile ownership among residents of these neighborhoods.[ci] In Alameda County, for example, the combined rate of pedestrian injury or death in high poverty areas is six times that in low poverty areas (12 cases per 1,000 people in high poverty areas vs. 2 cases per 1,000 people in low poverty areas).[cii]

There are also racial disparities in risks associated with pedestrian crashes.[ciii] A greater incidence of pedestrian crashes exists among minorities, and African American and Hispanic race and uninsured status are linked to increased risk of mortality.[civ]

Recommendations

Collecting data on collisions is important from health and equity perspectives. We recommend the following:

- Number of collisions, injuries, fatalities, and property damage by mode per month, broken down by income level, race/ethnicity, and rural/urban context per capita, lane miles, block group, and daytime population.

METRIC: EMISSIONS OF CO, NOX, PM2.5, PM10, SOX, AND VOC

The main pollutants produced by road traffic are nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOCs), black carbon (BC), fine particulate matter (PM), ozone, diesel exhaust, and sulfur oxide (SO). The Environmental Protection Agency finds that the most carcinogenic air pollutant is benzene.[cv] In California, 84% of benzene emissions come from motor vehicles.[cvi] Diesel particulate matter (PM) is identified by the California Air Resource Board (CARB) as a toxic air contaminant and represents 70% of the known potential cancer risk from air toxics in California.[cvii]

The health impacts of living near high traffic roadways have been well studied. Children living in close proximity to busy roadways have been found to suffer from increased respiratory disease symptoms and asthma, and reduced lung function.[cviii cix cx cxi cxii cxiii cxiv cxv cxvi cxvii] Studies also show higher rates of cardiovascular and respiratory disease among adults living near freeways, particularly for those living within 650 feet of heavy traffic and heavy truck volume.[cxviii cxix cxx cxxi cxxii] Long-term exposure to traffic-related air pollution is associated with an increased risk of lung cancer,[cxxiii] and diabetics exposed to air pollution have an increased risk for heart disease.[cxxiv cxxv] Additionally, living in areas with high levels of air pollution is a disincentive to exercise,[cxxvi] and exercise reduces risks for heart disease, diabetes, osteoporosis, and stress-related anxiety and depression.[cxxvii] CARB recommends not locating sensitive land uses within 500 feet (~150 meters) of a highway that has traffic in excess of 100,000 vehicles per day.[cxxviii] Incorporating high quality air filtration systems with regular maintenance schedules can mitigate the negative health impacts of infill development near busy roadways.

Equity impacts

Poorer residents and people of color are more likely to live near roadway sources of air pollution.[cxxix] In California, the proportion of children of color living in high traffic density blocks is inversely related to median family income, and children of color are three times more likely to live in high-traffic areas than white children.[cxxx] Thus, poorer children of color are more likely to be disproportionately exposed to respiratory-disease causing emissions.

Recommendations

Based on significant health impacts associated with vehicle emissions, we support the inclusion of this indicator. We also recommend the following supplementary metrics:

- Pre-mature mortality attributable to PM2.5 concentrations[cxxxi]
- Asthma incidence and exacerbations attributable to PM2.5 and/or NO2 concentrations[cxxxii cxxxiii]
- Stratification of emissions metrics and health outcome metrics by race/ethnicity, income, and proximity to roadways with high vehicle volume

METRIC: CO_2 EMISSIONS PER CAPITA

Automobile emissions include carbon dioxide (CO_2), a greenhouse gas (GHG) contributing climate change. Climate change is associated with a variety of health outcomes, most of which relating to extreme temperatures:

- During a two-week period of extreme heat in 2006 in California, there was a 6.3 times higher risk of being hospitalized for heat-related causes then during reference periods. Health issues noted in hospitalizations included renal failure, cardiovascular disease, diabetes, electrolyte imbalance, and nephritis.[cxxxiv]
- In a study of nine California counties from 1999-2003 during the summer months, each 10 degree Fahrenheit increase in temperature corresponded to a 2.3% increase in non-accidental mortality, independent of air pollution levels.[cxxxv]
- For each 1 degree Celsius rise in temperature in the US, there are an estimated 20 – 30 excess cancer cases and 1000 excess air-pollution associated deaths.[cxxxvi]
- Increased temperatures also increase the formation of ozone, an irritating gas that damages lung tissue and is associated with asthma attacks, coughing, chest pain and even death. During the heat waves in Europe in summer 2003 there were thousands of excess deaths above the seasonal average. Epidemiological studies suggest that 20-50% of the total excess deaths could be attributed to elevated ozone and particle levels that occurred during the heat waves.[cxxxvii] [cxxxviii]

Elevated temperatures can also indirectly cause health hazards, as changes in climate trigger other changes that could impact health. For example:

- Transmission of infectious diseases such as malaria, dengue and yellow fever could increase as insects carrying the diseases migrate northward into new climates.
- Allergic reactions may increase as trees, ragweed and other vegetation that give rise to allergenic pollens grow more profusely in a warmer climate.
- Extreme weather events such as floods, droughts, hurricanes, and tornadoes may increase as a result of climate change, and these events are likely to cause increases in deaths, injuries, infectious diseases (if contaminated run-off affects water supplies), and stress-related disorders.
- The quality and quantity of drinking water could decrease as water sources in some areas become threatened by drought. This could lead to health disorders related to water contamination by bacteria, viruses, protozoa and parasites.[cxxxix]

Equity impacts

People of color and the poor will suffer greater impacts from climate change, including higher mortality and health impacts (more frequent and intense heat waves, higher air pollution levels in urban areas, and lack of access to air conditioning). Additionally, urban residents experience the heat island effects from lack of tree canopy and increased impervious surfaces. Vulnerable communities include infants and children, the elderly, and people with heart and lung disease. Because they are already strained, the residents of such communities are less likely to be able to adapt quickly to the impacts of climate change. For example, people of color and low-income residents of New Orleans were hardest hit by hurricane Katrina.

Recommendations

Based on health and environmental consequences of climate change, we support the inclusion of this metric.

METRICS: SOCIAL EQUITY MEASURES (TBD)

Vast health disparities exist in communities affected by transportation and climate change decisions. For example, populations living in close proximity to freeways tend to be low-income communities of color. These populations also disproportionately face high burdens of asthma, cardiovascular disease, diabetes, and other chronic illnesses. These disproportionate health outcomes are often related to social inequities (e.g., living close to a freeway), but there are often a host of cumulative causes, many of which are currently unmeasured. While specific social equity measures are encouraged, we believe that incorporating demographic and neighborhood stratification into *most or all* proposed metrics would help to effectively track social equity goals.

Recommendations

Social equity measures are currently unspecified in the SCAG Draft 2012 RTP/SCS Goals and Performance Measures. Because every metric has the potential to affect various populations differently, and often disproportionate burdens accumulate in low-income populations and populations of color, we recommend that disparities be specifically measured. We advocate that social equity be integrated into each performance metric, and we have built equity considerations into each of the recommended metrics within this analysis. We recommend stratification by demographics (e.g., race/ethnicity, income, age, and/or other indicators of vulnerability to health risks) and/or place-based (i.e., neighborhood) stratification within all performance metrics.

METRIC: ECONOMIC IMPACTS (GROSS REGIONAL PRODUCT, TOTAL JOBS)

Health and equity impacts

Income is one of the strongest and most consistent predictors of health and disease in public health research literature New jobs that pay a self-sufficiency wage, provide benefits, are accessible to those with lower educational levels, and are near low-income communities are vital to improving the health and well-being of low income workers and their families.

- Attainment of self-sufficiency income predicts better health, improved nutrition, and lower mortality.[cxl]
- In one study, people with average family incomes of $15,000 to $20,000 were three times as likely to die prematurely (i.e., before the current average life span) as those with family incomes greater than $70,000.[cxli]
- People with lower incomes have higher risks than people with higher incomes for giving birth to low birth weight babies, for suffering injuries or violence, for getting most cancers, and for getting chronic conditions.[cxlii]
- Prevalence of obesity and Type 2 diabetes is higher among groups with the lowest levels of income and education and in the most deprived areas.[cxliii]

- A review found that lower socioeconomic status was adversely associated with psychosocial factors linked to coronary heart disease, particularly hostility and depression.[cxliv]
- Individuals who experience more frequent episodes of income loss are likely to have higher levels of depression.[cxlv]

Unemployment and underemployment are associated with poor health outcomes:

- Men who were unemployed in several cities in Europe were 1.5 - 3.25 times more likely than those who were employed to have ischemic heart disease.[cxlvi]
- Unemployment is associated with premature mortality cardiovascular disease, hypertension, depression, and suicide.[cxlvii] [cxlviii]

Jobs that do not provide health insurance and guaranteed sick leave contribute to poor health outcomes:

- The lack of sick leave benefits is associated with workers 1) coming to work sick, 2) working at lower levels of productivity, 3) risking infecting other workers, 4) experiencing longer recovery times, 5) experiencing worse health outcomes in children, and 5) utilizing higher cost health care down the line.[cxlix]
- Individuals without health insurance frequently forego timely health care, suffer more severe illness, and are more likely to die a premature death than their insured counterparts. Annually nationwide, 18,000 premature deaths are attributable to lack of health coverage.[cl]
- Having health insurance coverage is significantly associated with access to medical checkups.[cli] [clii]

Recommendations

We recommend the following:

- Total jobs stratified by income, race/ethnicity, education and benefits provided
- Percentage of jobs provided to local residents during major housing, business, and retail development and redevelopment projects

METRICS NOT ANALYZED

The following indicators proposed by SCAG were not analyzed because of limited understanding of the indicators and/or limited health impacts:

- Lost lane-miles
- Benefit to cost ratio
- Total cost per capita to sustain systems performance at base year levels
- Maintenance cost per capita to preserve system at base year conditions

- Fuel consumption
- Land consumption (land converted between non-urban and urban uses)

It is suggested to collect data stratified by income and race/ethnicity when possible for all indicators to determine if there is inequitable cost to low income communities and communities of color.

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